The invention relates to a method and an apparatus to the biological treatment of an organic sufficient loaded fluid, in particular waste water, under anaerobic conditions and under generation of fermentation gas.
Effluent is the designation for after domestic, commercial or industrial use changed, in particular contaminated, flowing off and into drains arriving water.
The biological treatment of highly loaded liquids and/or. the purification of waste water represents also a measure to the removing of organic pollutants from liquids, which are in this in solved, colloidal or fine-dispersed form contained, by mikrobielle activity. D. h. aerobic and/or anaerobic degradation with gassing under structure of new cell substance and sorption at bacteria flakes, biological lawns or mud granulates.
General one the made biological waste water purification in purification plants under utilization of the same and/or. similar events, which take place with the biological self-cleaning in a running waters, however in technically intensified form. Likewise also the anaerobic process in nature z finds. B. at the bottom of flat, standing waters instead of.
By anaerobic degradation one understands the conversion of organic fabrics by microorganisms by oxygen exclusion. With the anaerobic degradation of organic fabrics fermentation gas, D develops. h. a gas mixture, which consists to approximately 55 to 75% of methane, to approximately 24 to 44% of carbon dioxide and in traces of other admixtures.
Methods to the biological treatment of highly loaded fluids under anaerobic conditions presuppose one relatively high specificity of the fluids. They are suitable among other things for highly loaded fluids, in particular effluents, from the foodstuffs industry, the agriculture, the oil industry as well as the cellulose production. They permit thus often the treatment of ?concentrates?, devoted however usually no full cleaning and/or. complete conversion.
Known one is a plant to the anaerobic treatment of waste water of the Biothane corporation (firm folder, 7/92), which of a completed activated sludge basin consists, in which a group of separators in the upper range of the basin arranged is. With this plant waste water becomes over in the basin soil planned flowing in openings into the activated sludge basin introduced and the treated waste water over a device discharged planned in the upper range of the basin. This plant has and. A. the disadvantage that reaction and Nachklärbereich are spatial from each other not separated and can negative affect each other. For this reason also the activity of the activated sludge can decrease over the time strongly, and also difficulties can occur with the separation of sludge and liquid.
Furthermore known one is a plant to the anaerobic treatment of sewage of the ADI of system Inc. (Firm folder, AS 043/11 94), of simple, upward reaction basins completed by a film consists. In this reaction basin a primary reaction range, becomes introduced in whose mud bed from downside effluent, is a secondary reaction range and a Nachklärbereich arranged. Between primary and secondary reaction range a dipping wall is arranged, itself from the bottom of the reaction basin from extended. The high one of the dipping wall amounts to approximately 3/5 of the high ones of the reaction basin. Between secondary reaction range and Nachklärbereich likewise dipping walls are arranged, which extend from the surface of the effluent out bodenwärts. The high one of these dipping walls amounts to approximately 1/3 of the high ones of the reaction basin. Furthermore a discharge equipment is intended to the return of sludge into the primary reaction range in the lower range of the Nachklärbereichs. A disadvantage of this plant

consists of the fact that in particular the secondary reaction range of the Nachklärbereich is not spatial sufficient delimited, whereby the activity of the sludge within the secondary reaction range can decrease over the time significant. Also the method accomplished in this plant does not give consideration to the different biological ratios of the two reaction ranges. A further disadvantage of this method consists of the fact that the sludge is to only little used in the second reaction range because of the bottom.
The invention was the basis the object, a method and/or. to make available an apparatus to the biological treatment of an organic sufficient loaded fluid under generation of fermentation gas, some improved cleaning temperature and/or. Degradation, an improved methane gas yield, a substantially more favorable investment and a safe operation ensure. This object becomes by the method with the features of the claim 1 and/or. by the apparatus to the lead-through of this method after claim 11 dissolved.
The Unteransprüche concern preferable embodiments of the method of claim 1 and/or. the apparatus of claim 11.
The advantages of the invention consist of the fact that the inventive apparatus due to its compact construction with integrated gas memory to a significant place and cost saving (and. A. due to savings at insulating material) leads and in addition earthquake-proof and independent of setting is.
In the sense of the present invention by organic sufficient loaded fluids fluids are understood such as blood, liquid manure and prefered waste waters, which exhibit the for example subsequent parameters: > approx. 2000 mg BSB5/l (with cooler climate) and > approx. 500 mg BSB5/l (with warm climate).
An embodiment of the invention becomes below more near explained on the basis designs. It shows
Fig. 1 a schematic plan view of an apparatus to the biological treatment of effluent.
Fig. 2 a sectional view of the apparatus to the biological treatment of effluent in accordance with Fig. 1.
In Fig. 1 and 2 illustrated apparatus 1 to the biological treatment of effluent consists of a basin 2, in which a mixing and an acidifying range 3, an high load range 7, a light load range 9 and a Nachklärbereich 10 in mainstream direction H of the water one behind the other arranged are.
The dimensions of the basin 2 are variable in the far range and become from the individual properties of the supplied effluent certain. The length of the basin 2 knows z. B. between 50 and 200 m and the width between 20 and 100 m amount to. The basins know z. B. approx. 3 to 6 m deeply its.
The volumes of the single ranges are variable and can become by suitable variable positioning of the partition walls 12, 13 and 14 to the treatment process adapted. In the extreme case the light load range 9 can be strongly reduced, so that it can be shifted into the part of the Nachklärbereichs 10. The volumes of the single ranges know z. B. for brewery water 285 m< 3> (Mixing and acidifying range 3), 890 m< 3> (High load range 7), 1480 m< 3> (Light load range 9) and 120 m< 3> (Nachklärbereich 10) amount to.
The basin 2 is essentially prefered into soil the admitted and in earthwork way established. The bottom and the side walls of the basin 2 can with sealing sheets, z. B. from HDPE, sealed its.
The effluent arrives over the supply means 5 first in the mixing and acidifying range 3. In this range the pH value of the waste water becomes measured apart from the temperature

also (simple or doubly), whereby the pH value becomes 16 balanced by additions over the apparatus if necessary. If required knows the effluent in (or following) the mixing and acidifying range 3 for sulfur connection a Eisen-Verbindung, z. B. an iron (III) - salt such as FeClSO4, over the feeding device 17 to be admitted. Furthermore the effluent in the mixing and acidifying range can become 3 with the help of an agitator 4 mixed. Also led back activated sludge can become over the supply means 6 in the mixing and acidifying range 3 guided. Due to mikrobieller activity in the mixing and acidifying range 3 the organic contents materials of the effluent under not necessarily purely anaerobic conditions are changed especially acidified. On the other hand 3 mechanisms can be intended to the aeration and circulation of the effluent with air or oxygen (not shown), in order to intervene regulating in the mixing and acidifying range.
At the bottom of the mixing and acidifying range 3 prefered are discharge-laterally at least a dosing pump 18 intended with lines 31, whose nozzle-like outlet ports 42 in the high load range 7 flow. With the help of this pump or pumps much mixture z becomes in particular different as function of the value of the high load range 7. B. approximately to the bottom portion of the high load range 7 to eddy form ordered and under pressure course-promotes 40 to 60 l effluent per second. Also a change circuit of the lines 31 can come to the application, in particular if high organic ratings are present to save but particularly around pump energy.
The methanogene phase of the anaerobic dismantling process of the organic contents materials of the effluent finds within the high load range 7 (space load: approximately 25 to 40 kg CSB/m< 3> BVx D) and the light load range 9 (space load: approximately between 2 to 7 kg CSB/m< 3> BVx D) instead of. Both ranges represent an activated sludge bed (a specific Biozönose) as it were in each case. The use of two independent and different bacterial strains (Biozönosen) leads among other things to an improved methane gas yield. The activated sludge beds become for the high load range 7 alternative or additionally the Bedüsung 42 in each case by injecting (in variable form) water, water mud mixture and/or. Rücklaufschlamm, whereby latter over the discharge equipment 11 (existing from at least one pump 32 and the line system 33) from the Nachklärbereich 10 passed it can become, by jet nozzles 24h and/or. 24s, those at the base of the high load range 7 and/or. at the bottom of the light load range 9 intended are rolled over. To the further support of the circulation 7 and within the light load range 9 injecting mechanisms (not shown) know, z within the high load range. B. Aeration chains for climatic and/or. temperature-dependent heated fermentation gas, or agitators arranged its. The injecting mechanisms become fed with fermentation gas, which becomes and in a Gaserwärmer (not shown) the heated removed over the high load range 7 if necessary and the light load range 9 extending gas memory.
In the range of the high load range 7 stromabwärtigen regarding the mainstream direction H is for the back circulation of activated sludge and/or. Mud granulates a dipping wall 8 also inlet openings 29 arranged in middle high one intended, itself from the surface to nearly to the ground of the high load range 7 extended, whereby the distance between the dipping wall 8 and the partition wall removes 13 bodenwärts continuous. Particular injecting nozzles in the bottom portion as well as the general momentum higher within the rolling over range (not shown) secure the back circulation. Particular mechanisms (not shown), z. B. Paddle works, can become the resolution of blockages in the proximity

of the soil within the longitudinal range between the dipping wall 8 and the partition wall 13 in the bottom portion arranged.
The still part-loaded effluent arrives now over in the upper range the partition wall 13 planned outlet openings 19 into the light load range 9. If the effluent contains with difficulty degradable components or additionally explanation effects desired become, the residence time of the effluent can lie in the light load range 9 significant over the residence time in the high load range 7. Such effects become also by those more here on the far and final purification adjusted Biozönose achieved. Simultaneous one becomes a further explanation achieved, the following mostly aerobic final purification the facilitated.
The division in high load and light load range possesses also the advantage in the rest of that a good final clarification is after a light load range ever easier and more efficiently possible. The major advantages of a good final clarification are common the person skilled in the art.
In certain cases it is to be introduced favourably the high load range 7 partial or whole (continuous or in the change) with the help of an intended bypass line (here not shown) to umfahren and the waste water direct into the light load range 9.
Over the high load range 7 and the light load range 9 extended itself the gas memory training film 15, at whose edges circulating with weights provided immersing rags 30 are intended to the proper gas sealing. The film 15 is usually UVstable and is 25 provided with variable weights, in order to hold the pressure inside the gas memory constant. If these weights become formed as fillable chambers arbitrary with water, then the pressure can be in-regulated inside the gas memory. In cooler climatic areas the film 15 and/or the entire basin become 2 performed in thermally insulated form.
In the gas memory a device 20 is intended to the discharge by fermentation gas, becomes used over which the recovered fermentation gas for own and foreign heating purposes, for heating of industrial water, the strength and power generation and other uses.
A höhenverstellbarer injecting pot 39 can be assigned to the gas bubble 15 as safety relief valves over the wire 38. Furthermore 15 mechanical can be assigned a fixed circulation rope 40 with dial reading 41 to the filling announcement to the gas bubble.

In order to ensure a 100%ig to smell-free operation of the inventive apparatus or reach a heat isolating effect, can also the mixing and acidifying range 3 and the Nachklärbereich 10 with a gas-tight film (if necessary. thermally insulated) covered becomes.
The effluent arrives now by the light load range 9 over in the upper range the partition wall 14 (before in the distance and the dipping wall 28 the arranged is parallel) intended outlet openings 27 into the Nachklärbereich 10. Due to the separation of light load range 9 and Nachklärbereich 10 by the partition wall 14 and with larger amounts of water by building in the Nachklärbereich 10 in particular a mud-free flow of the clarified waste water becomes from the Nachklärbereich 10 and a significant more decreased and/or. eliminated mud drift ensured.
In the Nachklärbereich 10 the clarification of supporting lamella separators 21 is in direct proximity of the discharge mechanism 23 for the clarified waste water, those as overflow mechanism, z at, the slanting sidewall 36 of the basin transverserunning for mainstream direction H. B. as overflow tank, formed is intended.

For a continuous operation of the apparatus it is necessary to branch already treated waste water from the discharge mechanism 23 and to introduce over the supply means 26 prefered into the expiration range of the mixing and acidifying range 3, if by way of the supply means 5 sufficient fresh waste water cannot be supplied. This made usually automatically due to corresponding high organization. Furthermore clarified effluent can become from the discharge mechanism 23 and over the supply means 5 in the mixing and acidifying range 3 the dilution of fresh waste water introduced, if the fresh sewage z. B. one to high concentration at poison materials contains. Over the same return mechanisms the flow (here not shown) knows to tack of the heat exchange and/or. the avoidance of unnecessary heat losses with the mixing and acidifying range 3 or the supply means 5 in heat exchange brought become.
Surplus sludge can do 10 over the discharge equipment 22, which consists of a pump 34 planned at the base of the Nachklärbereichs 10 and the line system 35, in mud pole crude corners from the Nachklärbereich (not shown) or over the discharge equipment 22 and the supply means 6 in the mixing and acidifying range 3 guided become.
The cleaning temperature of the inventive apparatus lies between 80 and 90%. It can lie however due to the two different Biozönosen often also with over 90%. For the completion of the purification the effluent can over the discharge mechanism 23 into a following if necessary. solid appended apparatus II the aerobic cleaning of waste water, which can cover a stimulation range, an intermediate clarifying range, a Nachbelüftungsbereich and a Nachsedimentationsbereich, or only the two first ranges, passed become. The cleaning temperature amounts to with a such combination of anaerobic and aerobic purification approximately 99.5%. Prefered one will the surplus sludge from the Nachklärbereich of the apparatus II to the aerobic purifying of effluent over the supply means 6 or 26 in the mixing and acidifying range 3 passed, in order to optimize the surplus sludge balance.
For an operation in colder climate zones the mixing and acidifying range 3, the high load range 7, the light load range 9 can do and if necessary the Nachklärbereich 10 thermally insulated and additionally alternatively the mixing and acidifying range 3, the high load range 7 and the light load range 9 with heating mechanisms like 37, z. B. with hot water, provided become.

Claims:

1. Method to the biological treatment of an organic sufficient loaded fluid, which becomes performed in a basin, whereby the fluid

- first, subsequent is subjected to a mixing and an acidifying stage (A)
- in an high load stage (B) with back circulation of the activated sludge and then in a light load stage (C) an anaerobic degradation under Methanogenese is subjected, and subsequent
- becomes in a Nachklärstufe (D), from which also a mud feedback performed become can, clarified, whereby the fermentation gas resultant in the high load stage (B) and the light load stage (C) is caught.

2. Process according to claim 1, characterised in that the fluid a sewage is.

3. Process according to claim 2, characterised in that the sewage in the mixing and acidifying stage (A) agitated becomes.
4. Process according to claim 2 or 3, characterised in that the waste water in the mixing and acidifying stage (A) with led back activated sludge mixed becomes.
5. Process according to one of claims 2 to 4, characterised in that in the mixing and acidifying stage (A) the pH value of the waste water is adjusted.
6. Process according to one of claims 2 to 5, characterised in that the effluent is shifted in the mixing and acidifying stage (A) with a Eisen-Verbindung.
7. Process according to one of claims 2 to 6, characterised in that in the Nachklärstufe (D) set off sludge into the high load stage (B) and/or the light load stage (C) recycled becomes.
8. Process according to one of claims 2 to 7, characterised in that the sewage after pass of the stages (A) until (D) in the mixing and acidifying stage (A) recycled becomes at least partial.
9. Process according to one of claims 2 to 8, characterised in that the sewage after pass of the stages (A) until (D) under aerobic conditions purified becomes additional.
10. Process according to claim 9, characterised in that the aerobic purification a stimulation stage, an intermediate clarifying stage, a Nachbelüftungsstufe and a Nachsedimentationsstufe covers.
11. Apparatus to the biological treatment of an organic sufficient loaded fluid, in particular waste water, existing out

- a basin (2), in that
- a mixing and an acidifying range (3), are connected to which supply means (5) for the fluid,
- an high load range (7) to the anaerobic degradation of the fluid under Methanogenese, which is provided with a device (8) for the back circulation of activated sludge,
- a light load range (9) to the further anaerobic degradation of the fluid under Methanogenese, and
- a Nachklärbereich (10), which is provided with at least one discharge equipment (11) for mud feedback,

in mainstream direction of the fluid one behind the other arranged are, whereby mixing and acidifying range (3), high load range (7), light load range (9) and Nachklärbereich (10) by the partition walls (12), (13) and (14) from each other separated are, and
- a gas-tight film (15), which is formed over the high load range (7) and the light load range (9) extended and a gas memory.

12. Apparatus according to claim 11, characterised in that the mixing and acidifying range (3) with an agitator (4) provided is.
13. Apparatus according to claim 11 or 12, characterised in that the mixing and acidifying range (3) to supply means (6) for return activated sludge connected is.
14. Apparatus after one of the claims 11 to 13, characterised in that the mixing and acidifying range (3) with an apparatus (16) for adjusting the pH value in bond stands.
15. Apparatus after one of the claims 11 to 14, characterised in that the mixing and acidifying range (3) with a feeding device (17) for an iron connection in bond stands.

16. Apparatus after one of the claims 11 to 15, characterised in that in the mixing and acidifying range (3) at least a dosing pump (18) is intended, whose inlet with the mixing and acidifying range (3) and their outlet with the high load range (7) are located in connection.
17. Apparatus after one of the claims 11 to 16, characterised in that the device (8) for the back circulation of sludge as dipping wall formed is.
18. Apparatus after one of the claims 11 to 17, characterised in that the high load range (7) with that or the discharge equipments (11) for mud feedback in connection stands.
19. Apparatus after one of the claims 11 to 18, characterised in that within the high load range (7) at least one injecting mechanism for if necessary. heated fermentation gas arranged is.
20. Apparatus after one of the claims 11 to 19, characterised in that the partition wall (13) in the upper range outlet openings (19) exhibits.
21. Apparatus after one of the claims 11 to 20, characterised in that the light load range (9) with that or the discharge equipments (11) for mud feedback in connection stands.
22. Apparatus after one of the claims 11 to 21, characterised in that within the light load range (9) at least one injecting mechanism for if necessary.
heated fermentation gas arranged is.
23. Apparatus after one of the claims 11 to 22, characterised in that of the Nachklärbereich (10) with a lamella separator (21) provided is.
24. Apparatus after one of the claims 11 to 23, characterised in that of the Nachklärbereich (10) with at least one discharge equipment (22) for surplus sludge in connection stands.
25. Apparatus after one of the claims 11 to 24, characterised in that at the Nachklärbereich (10) a discharge mechanism (23) for effluent connected is.
26. Apparatus after one of the claims 11 to 25, characterised in that the basin (2) into soil the admitted is.